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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/935,964	08/23/2001	Makoto Higashiyama	F-7128	1542

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EXAMINER	
JANKUS, ALMIS R	

ART UNIT	PAPER NUMBER
2671	4

DATE MAILED: 02/03/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/935,964	HIGASHIYAMA ET AL.	
	Examiner	Art Unit	
	Almis R Jankus	2671	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *23 August 2001*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-18* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-18* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *23 August 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

13)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

a) ☐ The translation of the foreign language provisional application has been received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *3*.
4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

1. Claims 1-18 are presented for examination.

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1-7, 9-15, and 17 are rejected under 35 U.S.C. 102(b) as being anticipated by Watt et al.

With respect to claim 1, Watt et al. teaches the claimed "vertex sorting means for sorting the respective vertices of the polygons forming the solid model into visible-surface vertices facing in a direction toward a light source and hidden-surface vertices facing in a direction opposite from the light source", at pages 3-6 and 155-166. More specifically, since the instant specification discloses no particular type of "sorting", (i.e., binary sorting, bubble sorting, bucket sorting, etc.) it is assumed that "sorting" simply refers to determining which vertices of the polygon forming the solid model are visible-surface vertices facing in a direction toward a light source and which vertices are hidden-surface vertices facing in a direction opposite the light source. At pages 3-6

Watt et al. establishes the relationships among polygons, edges and vertices in computer representations of three-dimensional objects. Note that in figures 1.1 and 1.2, whether using polygon-based representation or edge-based representation respectively, a vertex array, including vertex coordinates and vertex normals, is a fundamental requirement. Further, at page 3, Watt et al. teaches that "Most renderers work with objects that are represented by a set of polygons", and "Geometric information is only stored at the polygon vertices". Now at page 161, Watt et al. teaches separating "polygons that can see the light from those that cannot". Given that a polygon's vertices are inherent to the polygon, it follows that a polygon "that can see the light" has vertices "that can see the light", and a polygon that cannot see the light has vertices that cannot see the light. Therefore, Watt et al. teaches the limitation of "vertex sorting means for sorting the respective vertices of the polygons forming the solid model into visible-surface vertices facing in a direction toward a light source and hidden-surface vertices facing in a direction opposite from the light source".

Watt et al. also teaches the claimed shadow model generating means for deforming the solid model by moving the hidden-surface vertices in a propagating direction of rays from the light source, at pages 155-166. More specifically, starting at page 160 Watt et al. teaches "shadow volumes". As can be seen at figure 5.6 and at the last paragraph of page 161, a shadow volume is generated by casting edges of those polygons which cannot see the light, away from the light. The solid model is "deformed" in the sense that a shadow volume is formed which extends from the silhouette edge of the solid model, in a direction away from the light. Since vertices

define the silhouette edge it is inherent that extending an edge also extends the vertices.

Claim 2 depends from claim 1 and further requires the vertex sorting means to sort the vertices into the visible-surface vertices and the hidden-surface vertices based on whether an inner product of a normal vector of each vertex of each polygon and a light source vector representing the propagating direction of the rays from the light source is a positive or negative value. Watt et al. teaches this at listing 5.1 on page 162. "NdotL" is the variable which contains the results of the inner product of the normals and light source vector; "see_table[I+1]" is the variable which contains the boolean true or false ("1 : 0") based on whether "(NdotL > 0.)?", i.e., whether the inner product has a positive or negative value.

Claims 3, 4 and 5 depend from claim 1 and further require the shadow model generating means to move specified vertices in parallel with the propagating direction of the rays from the light source (claim 3); defining a shadow model shape tapered in a moving direction (claim 4); and defining a shadow model shape swollen in a moving direction (claim 5). .

Watt et al. teaches this at pages 164-165 and 157. At pages 164-165 Watt et al. teaches generating shadow volumes due to an area light source which form an "umbra" shadow volume which is the intersection of shadow volumes generated from each vertex of the area light source. At page 157 at figure 5.2 Watt et al. teaches that the

umbra shadow is related to the size of the light source and the size of the shadowing object. As can be seen at figure 5.2, a light source which is larger than a shadowing object produces a tapered umbra shadow volume; a light source which is equal in size to the shadowing object produces an umbra shadow volume with parallel sides; and a light source which is smaller than the shadowing object produces an umbra shadow volume which is swollen in the moving direction.

Claim 6 depends from claim 1 and further requires shadow creating means for sorting the polygons forming the shadow model into front-facing polygons facing in a direction toward a viewpoint of a virtual camera and back-facing polygons facing in a direction opposite from the viewpoint of the virtual camera, and creating a shadow image in pixels which are pixels corresponding to the front-facing polygons minus pixels corresponding to the back-facing polygons.

Watt et al. teaches this at pages 163-164 and at pages 6-9. At pages 163-164 Watt et al. teaches "A frontfacing shadow polygon puts anything behind it in shadow while a backfacing shadow polygon cancels the effect of a frontfacing one. A polygon that lies between these two shadow polygons will be in shadow", and determining pixel values based on the juxtaposition of the shadow polygons with respect to the viewing direction (see figure 5.10).

Claim 6 also requires a "viewpoint of a virtual camera". Watt et al. teaches this at pages 6-9, more specifically at section 1.2.3 "Eye or camera coordinate system" which

teaches "virtual camera" merely being a convention for a viewpoint, which viewpoint can be seen at figure 5.10, and as a "view frustum" at figure 5.6.

Claim 7 depends from claim 1 and further requires shadow creating means for creating a shadow image of the solid model using the shadow model, first storage means for storing the created shadow image of the solid model, second storage means for applying rendering to the polygon models except the shadow model and storing the thus created image, and combining means for reading and combining the image stored in the first storage means and the one stored in the second storage means. Watt et al. teaches this at pages 3-9 and at page 160. The first storage means is taught at page 160 with the teaching of "The shadow volume itself is polygonal, being made up of shadow polygons which are generated and added to the polygonal database prior to rendering"; thus, this database entry suffices for the claimed first storage means. The second storage means is taught at page 5 at figure 1.1 which teaches the arrays used in a polygonal database. The database of figure 1.1 is used for applying rendering to the polygon models except the shadow models because, as is taught at page 160 "shadow polygons are invisible, in that they are not explicitly rendered and do not affect the visibility calculations". The combining means for reading and combining the image stored in the first storage means and the one stored in the second storage means is taught at page 160 with "Their function [shadow polygons] is, during the depth sort required by the hidden surface solution, to provide information to the real polygons of their positions with respect to the shadow volume".

Claims 9-15 are similar to claims 1-7 respectively, except that claims 9-15 require a readable storage medium storing a three-dimensional image processing program for generating a shadow model. Watt et al. teaches this three-dimensional image processing program for generating a shadow model at page 162 at listing 5.1 which is clearly readable, and stored on the medium of paper.

Claim 17 is similar to claim 1 but is drafted in method form. Claim 17 is rejected under the same rationale applied to respective components of claim 1 which perform the claimed steps of claim 17.

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of

each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

6. Claims 8 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Watt et al. as applied to claims 1 and 9 respectively, above, and further in view of Shigeru et al. (EP 0 916 374 A).

Claims 8 and 16 depend from claims 1 and 9 respectively, and further require the solid model to be a character movable in height direction in a simulated three-dimensional space.

Shigeru et al. teaches this feature at figure 18 which shows the changing ground shadows of leg characters as the legs move in a height direction; the simulated three-dimensional space is shown at figure 20.

It would have been obvious to one of ordinary skill in the art at the time of the instant invention to use a more realistic shadow generating technique as taught at Watt et al. with a character movable in a height direction in a simulated three-dimensional space, as taught at Shigeru et al. because when a shadow of an object is displayed on a ground object (a floor, water surface, earth surface, etc.) the three-dimensional realistic effects are enhanced, as taught at Shigeru et al. at column 1.

7. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Watt et al. in view of Shigeru et al.

With respect to claim 18, Shigeru et al. teaches the claimed video game system, at the abstract; the three-dimensional image processing apparatus for generating a shadow, at figure 2, item 10; the image display means for displaying images, at figure 2, item 30; the program storage means storing a game program data, at figure 2, item 21; the externally operable operation means, wherein the three-dimensional image processing apparatus displays images on the image display means in accordance with the game program data, at figure 2, items 40.

Watt et al. teaches the claimed generating a shadow model of a solid model formed by polygons each having vertex normal vectors, including: vertex sorting means for sorting the respective vertices of the polygons forming the solid model into visible-surface vertices facing in a direction toward a light source and hidden-surface vertices facing in a direction opposite from the light source, and shadow model generating means for deforming the solid model by moving the hidden-surface vertices in a propagating direction of rays from the light source, at pages 3-6 and 155-166 as applied to identical respective features at the rejection of claim 1 above.

It would have been obvious to one of ordinary skill in the art at the time of the instant invention to generate more accurate shadows, as taught at Watt et al. in a game system, as taught at Shigeru et al. because shadows play a subtle and vital role in our visual perception of an environment. The position and orientation provide information as to how objects relate to each other in space. This motivation is provided at Watt et al. at page 155, first paragraph.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Almis R Jankus whose telephone number is 703-305-9795. The examiner can normally be reached on M-F, 8-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Zimmerman can be reached on 703-305-9798. The fax phone number for the organization where this application or proceeding is assigned is 703-308-6606.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-305-4700.

AJ

ALMIS R. JANKUS
PRIMARY EXAMINER